

On Australian Entozoa, with descriptions of new species, by

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THE natural history of the intestinal worms has been much neglected in Australia, and we are not yet able to tell how many of the common European species have accompanied man and his domestic animals to this country. It has been ascertained on the other hand that some Entozoa, tape-worms for instance, of purely Australian origin infest our sheep, and it is a well known fact that the common sheep fluke (*Fasciola* or *Distoma hepatica*) has long occupied the biliary ducts of the kangaroos. Our rats are troubled with cysts which contain unmistakeable young tape-worms, (*Cysticercus fasciolaris*), and nearly every specimen which I examined carried several of them, from a few lines to two inches in length. It would be interesting to know in which animal this cestoid attains maturity.

Our water fowl are great cestoid bearers, and as these birds are easily obtained, I have first paid attention to these and now lay the result of my investigations before the Entomological Society of New South Wales.

New genera were not discovered; some of our species I found to be closely allied to European ones, (such as the Hammer-headed tape-worm (*Tænia malleus*); the young of other species were traced, and it was observed that they lived in prodigious numbers in the hosts which carried the perfectly mature "colony." My observations were made at first without the proper means, I had no microscope, and was without a standard work on the subject, both deficiencies were, however, kindly supplied by gentlemen interested in these researches, so that the next shooting season will find me better prepared to make correct drawings of the ova, and take the necessary measurements.

The ova have assisted me much in arriving at a final conclusion as to the character of the variable collection obtained.

I had jotted down and sketched, what I considered at least thirty species, and these in a great measure owing to the ova-test, were reduced to fifteen or sixteen. My practical acquaintance with Entozoa is of a recent date, but I find the subject of such interest that every moment which could be spared from other duties has been devoted to it. There is no necessity to point out the importance of the study of this group of animals to the well being of millions, but as many people consider it a particularly nasty subject, I will try and prove to them that it is not so.

The fresh intestines are put into a flat dish, and a stream of water is kept running over them till quite clean, a rough board beneath prevents the escape of any of the smaller Entozoa which the water may force out. The parts are then opened and after a gentle flow of the element for several hours, the worms may be picked out with a camel hair brush.

Not having time to make the usual preparations for the microscope, and being generally well supplied with duplicate specimens, I spread some out on glass slides, and observed them, making the necessary sketches at the same time; they dried gradually and the changes which the different parts underwent were carefully noticed. Whenever I wish to refer to a specimen it is put under the microscope, and any part, even if it is a cestoid of several feet in length, can be examined without difficulty. To clear up doubtful points, some wet preparations are necessary, and these are kept in glass tubes to be used when the first plan fails.

When once dry, the objects are transparent, and under the glass look most charming—the fact is, few persons unacquainted with them will believe what they are. Some retain their colour, and are therefore still more valuable.

I have mounted the largest flukes in the same way, but had to keep them for a day or so in water and press them slightly when they were too thick. With a view of giving some idea of the arrangement of the Entozoa, I have added Professor von Siebold's system, and I need not observe that his first order of *Cystici* is now generally accepted as part of the Cestoidea; the genera arranged under that head being no doubt young tape-worms.

Class. HELMINTHES.

It is very difficult to characterize the class Helminthes, for it contains animals having widely dissimilar organization. On this account the separation of its groups and their distribution among the other classes of the invertebrata has been attempted. But such various difficulties have arisen from this, that for the present it is best that all these animals should remain together. If a common character is not furnished by their structure, it must be sought for in their manner of life; for nearly all are parasites, and during their whole life or at least during some of its periods, seek their abode and nourishment in or upon other living animals.

Order I. CYSTICI.*

The body is swollen in form of a bladder, and filled with a serous liquid. Digestive and genital organs are wanting.

Genera: *Echinococcus*, *Cœnurus*, *Cysticercus*, *Anthrocephalus*.

Order II. CESTODES.

The parenchymatous body is riband like, having often incomplete transverse fissurations; often it is wholly divided transversely into rings. Digestive organs are wanting. The genital organs of both sexes are combined in the same individual, and generally are often repeated. Copulatory organs are present.†

Genera: *Gymnorhynchus*, *Tetrarhynchus*, *Bothriocephalus*, *Tænia*, *Triclenophorus*, *Ligula*, *Caryophyllæus*.

* Nearly all the genera of their order are considered to be young tape-worms.—G.K.

† Von Siebold has changed his opinion, and states some years later "On the Tape and Cystic worms." (translated by Professor Huxley, London, 1857, page 40)." The sexually matured individuals of the *Cestoidæ* are no other than their full grown joints in which are developed the male and female genitalia, by whose co-operation eggs capable of reproduction are generated, and the continuation of the species is secured. Such a sexually-mature hermaphrodite joint of a cestoid worm which separates from the body of the scolex with great readiness, is denominated a *Proglottis*. The formation

Order III. TREMATODES.

The body is parenchymatous and usually flattened. The intestinal canal, which is often branching, has a mouth, but nearly always is without an anus. The genital organs of both sexes are combined in the same individual. Copulatory organs are present.

Genera : *Gyrodactylus*, *Axine*, *Octobrothrium*, *Diplozoon*, *Polystomum*, *Aspidocotylus*, *Aspidogaster*, *Tristomum*, *Monostomum*, *Holostomum*, *Gasterostomum*, *Pentastomum*.

Order IV. ACANTHOCEPHALI.

The sack-like body is flattened, transversely striated, and swollen cylindrically by the absorption of water. Digestive organs are wanting. The genital organs are situated in separate individuals. Copulatory organs are present.

Genus : *Echinorhynchus*.

Order V. GORDIACEI.

The body is filiform and cylindrical. The digestive organs

of these *Proglottides* takes place at the posterior end of the scolex by a sexual reproduction, viz., by a simple process of growth and division. If we compare this process with the phenomena of the alternation of generations, we shall discover in it all the essential characters of the latter. The matured joints or the sexual individuals of the *Cestoidea* in their proglottis form, produce a brood of embryos armed with six hooklets (see plate III., figs. 22 and 23 of this paper—G.K.) which are quite dissimilar in shape from their parents, the Proglottides, (see plate III., fig. 21*b* of this paper—G.K.) and remain so, since at a later period they assume the scolex form, and take on the functions of an agamozoid. From the posterior end of the body of such a scoliceform agamozoid a series of joints are developed,—that is to say, a generation of sexual individuals which again present the original proglottis form. In their organization the *Proglottides*, apart from their sexual apparatus, so far resemble the scolices from which they have been produced, that they possess no oral aperture, and moreover are subject to a deposit under their integument of those glassy calcareous particles which I have already mentioned. (A good idea of a young scolex will be obtained by comparing the 2nd plate, figs. 2*b* and 2*c*, with the adult form figs. 2 and 2*a*—G.K.) It seems, at first, paradoxical to say that the joints of a tapeworm which have hitherto been believed to be mere parts of one animal, should be considered as individuals; but whoever will observe with

are without an anus. Genital organs are situated upon separate individuals. Copulatory organs are sometimes present.

Genera : *Mermis*, *Gordius*.

Order VI. NEMATODES.

The body is sack-like and cylindrical. The digestive canal has a mouth and anus, and passes in a straight line through the cavity of the body. The genital organs are situated upon separate individuals. Copulatory organs are present.

Genera : *Sphaerularia*, *Trichosoma*, *Trichocephalus*, *Filaria*, *Anguillula*, *Physaloptera*, *Liorhynchus*, *Lecanocephalus*, *Cheiracanthus*, *Gnathosoma*, *Ancyracanthus*, *Spiroptera*, *Hedruris*, *Strongylus*, *Cucullanus*, *Oxyuris*, *Ascaris*.

I consider it also necessary (for the purpose of making those interested better acquainted with what has been written on Australian Entozoa) to give a complete list of the species already described. This I propose to do in chronological order.

The first Australian intestinal worm (*Tenia festiva*) was noticed by Rudolphi in the year 1819, in his "Entozoorum

an unprejudiced eye, a fully developed *Tenia* with its sexually matured joints, must be convinced that it is no simple animal, but one composed of many individuals."

On page 44: von Siebold remarks:—"In the *Cestoidea* the stock is the posterior end of the scoliceform agamozoid (the head G.K.) In the alternation of generations amongst the *Cestoidea*, there is this peculiarity that the agamozoid preserves its efficacy and independence, whilst the agamozoids of other animals which undergo alternation either die after producing their brood or pass into it. (Huxley doubts this: G.K.) We must consider the head of every cestoid worm as the agamozoid still remaining and capable of reproduction, and its neck as the equivalent of the posterior extremity of the scolex. In all cestoids we see that fresh joints are continually being developed at the posterior part of the neck which lengthens and becomes covered with transverse folds. These folds are at first very close together, but as the process of growth throws them backwards further and further from their place of origin, they gradually change from indistinct wrinkles into sharp transverse lines of demarcation, between which the substance of the body dilates into a joint (individual), and assumes its specific shape. At a later period the rudiments of the hermaphroditic sexual apparatus make their appearance in the interior of the joints, and finally they separate themselves from their younger fellows as independent individuals."

Synopsis," page 146, from the intestines of the Great Kangaroo (*Halmaturus giganteus*.) The second discovery was, that the common sheep fluke (*Distoma* or *Fasciola hepatica*) inhabited the biliary duets, and the liver of Kangaroos (Ib. page 725). No description of Australian species occurs till February 8th, 1853. (Proceedings of the Zoological Society of London for 1853, pages 18 to 25), when Dr. Baird describes the following species:—

Ascaris similis.—From the stomach of a Seal.

Mermis rigidus.—Habitat unknown but probably Australian.

Tænia Goezii.—Habitat unknown, probably Australian.

Tænia Cederi.—Habitat. The stomach of a Penguin from the Antarctic seas.

Bothriocephalus antarcticus.—Habitat. The stomach and intestines of a Southern seal.

In the year 1859, Dr. Baird described (Proceedings of the Zool. Soc. of London, page 111). *Tænia sulciceps*, from the intestines of the Wandering Albatross (*Diomedea exulans*), and also noticed a rare species of *Ascaris* from the Dugong described by Professor Owen as *Ascaris halichoris*, (Ib. pages 148 and 149).

In 1861, Dr. Baird noticed a small *Filaria* (*Filaria sanguinea*) in the stomach of a little Australian fresh water fish (*Galaxias scribe*).

In the same publication for 1862, I find a description of a new *Pentastoma* (*Pentastoma teretiusculum*) by Dr. Baird, (page 114) who mentions that he took the specimen from the mouth of a snake (*Hoplocephalus superbis*), which died at the Zoological Society's gardens. I may state here that this worm is generally found in the lung of Australian snakes.

The last of Dr. Baird's descriptions occurs in the Proceedings of the Zoological Society for 1865, page 58, and relates to a new cestoid worm (*Bothridium* (*Solenophorus*) *arcuatum*.) This species is common in the Australian Diamond snake (*Morelia spilotes*).

In that most useful book the "Zoological Record," I find mention made of an Australian tape-worm from the stomach of the Emen (*Dromaius novæ-hollandiæ*), which is described by the Danish Naturalist Krabbe (Record for 1869, page 635), as *Tænia australis*.

The following species were taken by myself and by Mr. George Masters in the neighbourhood of Sydney and in Queensland :—

MAMMALIA.

From a Dolphin (*Delphinus Forsteri*)—

1. A species of *Tænia*.
2. A species of *Distoma*.
3. An *Ascaris*.
4. An *Echinorhynchus*.

From a Kangaroo (*Macropus major*)—

1. A Fluke (*Fasciola hepatica*).

From a Bandicoot (*Perameles nasuta*)—

A species of *Ascaris*.

From a domestic Cat (*Felis catus*)—

An *Ascaris* (*Ascaris mystax*).

From a Sheep (*Ovis aries*)—

1. *Amphistoma conicum* (?)
2. *Strongylus filaria*.
3. *Ascaris* spec. (?)

From a Pig (*Sus scropha*)—

1. *Strongylus suis*.

From a Wallaby (*Halmaturus*)—

1. A species of *Tænia*.
2. A second species of *Tænia*.

From a Phalanger (*Phalangista vulpina*)—

1. A species of *Tænia*.

AVES.

From a black Duck (*Anas superciliosa*)—

Several species of cestoid worms.

From a Bower Bird (*Chlamydera maculata*)—

1. A species of *Tænia*.

From a Pigeon (*Columba livia*)—

1. A species of *Ascaris*.

From a White-eyed Duck (*Nyroca australis*)—

1. A cestoid worm, a quarter of an inch and more in width, and several feet in length.
2. Several other smaller species of *Tænia*.

From a Teal (*Anas punctata*)—

1. Several cestoid worms, including the young of the Australian Hammer-headed Tape-worm.

From a Porphyrio or Red-bill (*Porphyrio melanotus*)—

1. A very small species of *Distoma*.

From a White Crane (*Herodias alba*)—

1. A very large *Distoma* which is distinguished from all others in having the vaginal papilla below the ventral pore, and not as usual between this pore and the oral sucker.

From a Pacific Crane (*Ardea pacifica*)—

1. A species of *Distoma*.

From a Snake Bird or Darter (*Plotus novæ-hollandiæ*)—

1. A new species of *Ascaris*.

From a Little Grebe (*Podiceps australis*)—

Several species of *Tænia*.

From a Stilt (*Himantopus leucocephalus*)—

Two cestoid worms.

From a Shoveller Duck (*Spatula rhynchotis*)—

A very curious short cestoid worm with very large head.

From a Musk Duck (*Biziura lobata*)—

A fine species of cestoid worm.

From a Gill Bird (*Anthochaera carunculata*)—

A series of *Ascari* taken from the eye by Mr. George Masters.

REPTILIA.

From a Tortoise (*Elseya dentata*) inhabiting northern Rivers—

1. A species of *Amphistoma* taken by Mr. George Masters.
2. A species of *Ascaris*.

From a Lizard (*Egernia Cuninghamsi*)—

1. Numerous very small and still undetermined Round Worms, some with long pointed tail.

From a Cyclodus or Sleeping Lizard (*Cyclodus gigas*)—

1. A species of *Physaloptera*.

From a White's Hinulia (*Hinulia Whitei*)—

1. A species of *Ascaris*.

From a Ribbon Lizard (*Hinulia taeniolatus*)—

1. A species of *Pentastoma*.

From a Gecko (*Diplodactylus ornatus*)—

1. A species of *Pentastoma*.

From a Gecko (*Phyllurus Miliusi*)—

1. A species of *Ascaris*.

From a Diamond Snake (*Morelia spilotes*)—

1. A species of *Bothridium*, probably identical with *Bothridium arcuatum* Baird.
2. A species of *Ascaris* with very long spiculæ.

From a Carpet Snake (*Morelia variegata*)—

1. A species of *Ascaris* identical with the above.

From a Grey Snake (*Diemenia reticulata*)—

1. Males and females of a large *Pentastoma*, found attached to the lungs.
2. A species of *Physaloptera*.
3. An *Echinorhynchus*.

PISCES.

From a large vegetable feeding Percoid Fish

1. A species of *Distoma*.
2. A Round Worm probably a species of *Trichocephalus*.

From a "Forster's Ceratodus" (*Ceratodus Forsteri*)—

1. A species of *Ascaris*, obtained by Mr. George Masters.

The following descriptions are those of the new species :—

TÆNIA TUBERCULATA.

(Plate I., figs. 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 21a.
Plate II., fig. 3).

Total length seldom exceeding 42 inches, average breadth one quarter of an inch, specimens occur however, which are half an inch wide in some parts. Head small, variable, often attached to a long slender neck which more frequently ends in a filament. Tapering specimens such as figured on Plate II. (fig. 3), are common; the neck appears quite perfect but not a vestige of a disk, sucker or proboscis can be observed. I examined more than 25 White-eyed Ducks (in which this tape worm is principally found), and obtained over fifty specimens but only five or six were furnished with heads such as are sketched (much enlarged) on Plate I. (figs. 12, 13, 14, 16, 19, 20, 21, and 21a). The general form of this cestoid resembles fig. 9 of Plate I. Owing to the many tubercles distributed over the posterior portion of the segments, the appearance of the colony is irregular though the marginal lines are generally straight. The anterior portion for about one-fifth of the total length is provided with very close segments directly after which the lemniscy appear, one on each side of every joint, the edges enlarging till they look in the most posterior proglottides, like small mammæ.

Plate II., fig. 3, shows the size of the segments well, the figure is from a photograph of a dried specimen, and reproduced here to show the exact length and width of the immature and lemnisci-bearing segments. Tubercles and mammæform lemnisci have dried in such a manner that their position is quite obliterated.

The lemnisci proper are covered by a short tube, and in dry objects this covering appears to be provided with very small spines, I mention this because such a spinous integument occurs only in the species under discussion. and has not yet been observed in any other Australian cestoid worm. The discharging or male organs are seldom much produced, they just peep out of the covering tube, though once I have noticed a lemniscus with a bell

shaped head which is figured (much enlarged) on plate I., No. 15.

I have taken great pains to ascertain how far I am justified in classing so many different-headed cestoid colonies as one species, but as all contain the same kind of ova, (circular bodies enclosing a granular round central capsule without hooks), I must be correct in my observation.

Besides no other cestoid examined was in any way tuberculated. One species closely resembles the present one, and broken pieces of it gave much trouble when classifying the specimens obtained during a day's collecting, but as soon as the test was applied, the different shaped ova proved the fragments to be of another form and not those of *Tenia tuberculata*. I mentioned already that the principal host to this tape-worm is the White-eyed Duck (*Nyroca australis*).

Many specimens are in the collection of the Australian Museum.

TENIA NOVÆ-HOLLANDIÆ.

(Plate I., figs. 1, 1a, 1b, 1c, 1d, 1e, 2, 3, and 18.

Plate III., figs. 28 and 28a).

This species resembles the one previously described and is almost as variable, with regard to the shape of the anterior portion of the colony at least.

Specimens with short tubercular or thin thread-like processes surmounting the broader and thicker "body" or "colony" are common, (figs. 1b, 1d, and 18 of Plate I.), others occur in which four indistinct suckers can be traced on the most anterior of the segments; others again resemble the figure given on Plate III., No. 28 and 28a, they show four round disks and a retracted proboscis, but all produce the same kind of ova. (Plate I., figs. 2 and 3.) The most common form consists of an oval disk enclosing a tube with round caps at each end and four hooks in the middle. Another ovum occurs with the ends more arched, and the sides bulged out like a cask, (probably a more advanced state) and a third, perhaps an earlier stage, has a double cap on one extremity of the tube (Plate I., fig. 1c.) The last

was noticed only in one fragment, (Plate I., fig. 1c, nat. size) and its shape may be accounted for, because the ovum was obtained from a very anterior segment; no hooks were seen in it. The present species seldom exceeds 18 inches in length, shorter specimens are, however, of more frequent occurrence. Owing to the lemniscy being long, tapering, and often well thrust out, the sides of a colony appear quite fringed; it is also a curious fact that many of the segments are provided with these organs almost to the very first one. This peculiarity is not shown on Plate I., fig. 1, because I had not noticed it when the sketch was made on account of the lemnisci laying close to the joint, I found, however, afterwards that they always reach right up the sides of the neck, and can be seen with a lens. The joints of the colony are regular and very closely packed for the first inch or two, the last being generally wide and thick. The anterior part in some specimens is very thick also.

Fig. 18 of Plate I. is an enlarged representation of the anterior part of one of the examples which is surmounted by a pennant-like filament. All the specimens obtained were found in the Little Grebe (*Podiceps australis*).

TÆNIA PARADOXA.

(Plate III., figs. 18, 19, 20, 21, 21a, 21b, 22, 22a, and 23).

General form like *Tænia novæ-hollandiæ*, segments smooth, lemnisci absent. The head is sometimes surmounted by a short proboscis rising between four small distinctly margined suckers or pores, (Plate III., fig. 18.) In other specimens the proboscis is not visible (Plate III., figs. 19 and 20.) At first sight I have often confounded this one with the species which inhabits the intestines of the Little Grebe (*Podiceps australis*), but as the ova differ much in both, I have no doubt that it is distinct.

The ova are round, in fact perfectly circular, covering an oval or half oval body with (in the latter case) a produced smaller half circle in the middle of the less rounded side, (Plate III., figs. 22, 22a, and 23.) The hooks are distributed alike in both varieties. The two middle ones vertically and each outer pair in a horizontal position.

Specimens occur from 12 to 18 inches and more in length, and a quarter of an inch wide. Fig. 21*b* of Plate III., represents the posterior segments of the natural size, and fig. 21*a* of the same Plate is a view, (natural size) of the head and neck; the small dot surmounting the figure represents the natural size of 21*a*.

The Little Grebe (*Podiceps australis*) is the only bird in which the *Tænia paradoxa* has hitherto been found.

TÆNIA FORSTERI.

(Plate I., figs. 4, 5, and 6).

Head rather large with four distinct oval suckers or disks, neck distinct, short, closely articulated, the segments being very small but clearly separated. A prominent tubercle on the anterior margin of each disk.

The joints enlarge gradually, their margins are straight, and only the last two or three larger than the rest, the terminal joint being the narrowest in width. Total length two inches and a half.

I have not been able to obtain a single ovum from the few specimens examined, and I find also that the shape of the suckers differs; some heads appear to have them more rounded and the corner tubercle very small. The segments are not furnished with lemnisci.

Habitat: from the stomach of a Dolphin (probably *Delphinus Forsteri*), caught in Port Jackson.

TÆNIA FIMBRIATA.

(Plate I., figs. 22 and 22*a*).

A single fragment about two inches and a half in length and a quarter of an inch wide, is all what I have seen of this singular form. There is no head, and the joints are close together keeping at a uniform distance throughout. The lower margin of each is fringed or rather cut out, in a triangular manner, and the edges are turned over, which gives the fringe a thick appearance. The joints cover each other slightly, and the whole looks like

a piece of coarse fibre-matting. The head and neck of this species are missing. Lemnisci occur on both sides, and as the joints are narrow they look very rough and tattered. Mr. Masters who collected the specimen several years ago, was not able to remember the habitat; it is probably from a Northern Wallaby.

TENIA FLAVESCENS.

(Plate I., figs. 23, 23*a*, 23*b*, and Plate II., fig. 5).

Total length seldom exceeding two inches, head larger than the broadest proglottis, or from $\frac{1}{16}$ th to $\frac{1}{8}$ th of an inch in diameter.

Head sub-quadrangular, with rounded corners, and bearing four, deep and distinctly margined suckers. Neck segments very close for the length of a quarter of an inch or more, after which they gradually enlarge to the last one, which is smaller. The marginal lines are very seldom quite straight, and the edges much produced outwards. Lemnisci were not observed but the posterior half of the joints is furnished each in the centre with a distinct receptacle full of ova. At first these ovaria, if I may call them so, are but scantily filled, but they increase in size and become fuller till the last three or four are completely stuffed out so that the marginal lines between them are altogether obliterated, (Plate II., fig. 5.) The head is broad and rather flat, the neck contracted, and the four circular disks are right upon the upper surface with a small tubercle in the middle. (Plate I., figs. 23, 23*a*, and 23*b*. The disks are not large enough in the sketch).

This is one of the four species in which the colour is beautifully preserved, the proglottides being pencilled and spotted with the most exquisite chrome yellow. I may state that I refer to dry specimens and not to the usual wet preparations; the process of preservation has been already explained. The Blue Winged Shoveller (*Spatula rhynchotis*), and the Black Duck (*Anas superciliosa*) are the birds in the alimentary canal of which the present species is found. The first one owing to its very narrow and slender intestines is almost destitute of *Tenia*, and whenever these are present, they generally belong to the species just described.

TÆNIA CYLINDRICA.

(Plate II., figs. 6 and 6a).

The head is a little less in size than the broadest proglottis, much produced beyond the neck, subquadrangular with rounded corners, and with four margined suckers and a tubercular proboscis in the middle. The body consists of closely packed joints not flattened out but perfectly cylindrical; only the posterior segments are slightly larger than the others. The beautiful yellow color so prominent in the allied species described before has not been noticed in this one, nor can any lemnisci be traced.

Habitat: the intestines of the Black Duck (*Anas superciliosa*). Total length half an inch, and one sixteenth of an inch wide. I have noticed a few much smaller specimens in which the head was as large as the whole body, but as I could not see any difference except in size, I have arranged them provisionally with the present species.

TÆNIA CORONATA.

(Plate I., figs. 7 and 8).

Head produced beyond the neck, crown-shaped, with four large disks and a small proboscis. The neck forms one-fourth of the total length at which distance the joints begin to increase in size, the last, which is three lines in width, being the largest. The lines between the segments are undulated, and appear to be divided into two or three ridges or elongate tubercles with sometimes an additional one near the openings for the lemnisci, which are regular and double. Their situation is the upper corner of each proglottis, they are surrounded by a raised line and scarcely protrude, so that they are easily overlooked. The lower portion of each joint bulges out and overshadows the lemniscus of the next one.

Total length three inches and a half, of which about one inch forms the thinner part of the neck. The proglottides are rather wide in a vertical direction, that is in proportion to the size of the colony; in the middle I counted 12 segments covering a dis-

tance of three lines. No ova were obtained, and there is only a single specimen in the Australian Museum collection.

Habitat: the intestines of the White-headed Stilt (*Himantopus leucocephalus*).

TENIA MASTERSII.

(Plate II., figs. 8, 8a, and 8b).

Head rather small, rounded, not much produced beyond the neck, narrow, with four round and rather indistinct disks. The articulations commence close to the head, gradually enlarging, but not growing much in a vertical direction. Lower margins straight. Four or five deep impressions, forming straight lines, run from the neck to the terminal joints, the outer lines being particularly distinct. Lemnisci were not observed, the specimens appearing all immature, judging from the last rather long and contracted joint; the "Narbe" (scar) of German authors.

Total length from 4 to 5 inches, and about one-eighth of an inch wide in the centre of the colony.

Habitat. The intestines of a species of Wallaby (*Halmaturus*) shot by Mr. George Masters in Queensland.

TENIA PHALANGISTÆ.

(Plate II., figs. 7, 7a, 7b, and 7c).

Head, pear-shaped with four large but not very prominent disks upon the upper surface. The disks are flat and not encircled by a ring. Head otherwise granular, and without spines. The neck is considerably contracted at its commencement, and for the first line, (one-twelfth of an inch) does not show any segmentation, it gradually widens out below this point and the joints become distinct. A single specimen is all I possess at present, which is four inches in length. The joints are irregular and distorted, one appears to grow into the other, there are interruptions of the marginal lines, and now and then the joints resemble a series of loops. This state occurs however on the first or anterior half of the colony only. On the remaining portion of the specimen the joints are regular. Some raised

dots became visible near the middle of the more posterior segments, but always more on one side than on the other. These dots increase in size as the joints approach the end. No lemnisci have been observed, though many discharged ova were noticed in all directions, some on the side of the head and others on the corners of various joints, (Plate II., figs. 7 and 7a).

Habitat, the intestines of the common Phalanger, (*Phalangista vulpina*.)

TÆNIA PEDIFORMIS.

(Plate II., figs. 2, 2a, 2b, and 2c).

The present species resembles the Hammer-headed Tape Worm of Rudolphi, figured by Bremser, (Icones Helminthum, Plate XV., fig. 17, 18, and 19), and like its European representative inhabits the intestines of various ducks, in this country. Our species are rather larger than the European ones, and more elegant in form, the hammer or foot-like frill is completely articulated, and in very young specimens this part is perfectly erect. It is only when the joints have reached the adult stage, that the "head" or rather the head and neck combined assume the horizontal position with which Helminthologists are most familiar. For the head proper (the first joint or agamozoid) I have looked in vain, and only in one or two instances did I observe two slight sucker-like depressions on the very tip of the thinnest part of the "hammer."

My best and largest specimen was seven inches in length, and occasionally one-eighth of an inch wide; the hammer-shaped combination of head and neck measuring three-eighths of an inch from one extremity to the other. In young specimens the whole, in adults only two-thirds of the appendage, shows articulations, the remaining or lower portions being granular. The joints are very irregular, and occasionally a few indistinct divisional lines appear, but they can never be traced with certainty. There is no sign of any lemnisci, and the edges of the greater portion of the colony are crowded with ova, which during the drying process were copiously discharged. I was unable at the time to sketch them. This species inhabits the intestines of the Black Duck (*Anas superciliosa*), and the Teal (*Anas punctata*).

TÆNIA MOSCHATA.

(Plate II., figs. 9, 9a, 9b, and 9c.)

Head rather prominent, square, with four rounded and produced disks one at each corner. The upper part of the head is divided by a cruciform band with a tubercle in the middle. The segments are not very close together, except on the neck, but are regular in shape, the terminal ones being about a line and a half wide. Total length ten or eleven inches, the greatest breadth being about one-eighth of an inch.

The lemnisci are situated on one side only, near the upper edge of each proglottis, and commence at the distance of half an inch below it, some appear broad and marked with lateral stripes (fig. 9a), others are long and tapering (Plate II., fig. 9c), it is possible, however, that the broad lemnisci are tubes only, the organ being not thrust out. The long and tapering ones occur on the terminal proglottides.

A single perfect specimen taken from the intestines of the Musk duck (*Biziura lobata*) is in the Australian Museum collection. On Plate II. is figured No. 9, the head much enlarged; No. 9b, enlarged proglottides with lemnisci; and 9a and 9c, the organs themselves also enlarged.

TÆNIA RUGOSA.

(Plate II., figs. 4, 4a, 4b, and 4c).

Head small, surmounted by an unarmed proboscis, and now slightly distorted, but fresh probably resembling the head of the Common Duck Tape-worm (Plate III., fig. 4.) The head is provided with the usual four indistinct disks and numerous granular markings, and is attached to a tapering neck which rises suddenly from the base of the more mature segments (Plate II., fig. 4b), and is much contracted just below the head. The proglottides or joints appear mature at the base of the slender neck, they are of moderate size often almost square (fig. 4c), and very rugose (fig. 4, enlarged view.) The lemnisci are on alternate sides, only one to each joint, they are pendulous, short, and covered by a thick sheath. The proglottides resemble those of *Tænia*

solum. Total length 5 inches and $\frac{1}{8}$ th of an inch wide in the broadest part. A single specimen is in the Museum collection which was obtained from the intestines of a White-headed Stilt. (*Himantopus leucocephalus*), shot at the River Hunter, New South Wales.

TÆNIA CHLAMYDERÆ.

(Plate II., figs. 1, 1a, 1b, and 1c).

This is a small species which occurs in the intestines of the Spotted Bower Bird (*Chlamydera maculata*) of this colony. It seldom exceeds three inches in length by a line (one-twelfth of an inch) in width. The head is rounded, flat on the top, and provided with four comparatively large disks or suckers, which in some specimens are separated from each other by grooves. The segments are as usual narrow at the neck, widen out gradually, and show a rather broad marginal line on the upper part with the two lower portions of each joint more or less rugose. Lemnisci could not be discovered. I give a few rough figures on Plate II., No. 1, showing the natural size of the specimen, with an enlarged view of the head, No. 1a, which is rather distorted, the specimen having been crushed, and of some of the joints No. 1b.

TÆNIA BAIRDII.

(Plate III., figs. 1 to 16, and figs. 24, 24a, 26, 27, and 27a).

Looking at the heads of a series of these cestoid worms, it would be quite natural to divide them into at least six species, but as no more than two varieties of ova can be obtained from many supposed species, it is clear that we must look at them as being all identical with one another.

The total length of a mature colony is from three to seven inches, and the broadest posterior proglottides seldom reach the width of one-eighth of an inch. In very few examples lemnisci have been observed, but whenever this was the case, they were noticed to be of great length, from one-third to one-fourth of the width of a proglottis. Many of the mature joints have burst by accident, and in every case the ova were elongate, tube-like or

cylindrical in form, the smaller ends slightly rounded off, and containing an S-shaped or roller-like granular body in the centre. On a few occasions four raised lines were noticed in the middle of these bodies, I am unable to say, however, whether they were really spines or not. On Plate III., I have sketched three kinds of ova, but all appear to be identical with one another, as a reference to figs. 2, 6, and 16 will easily show.

After another trial with tape worms the heads of which resemble in shape, figs. 1, 4, 5, 15, and 16*a* of Plate III., I have obtained nothing but ova as figured under No. 16, granular in the centre and without hooks or spines, I cannot but conclude therefore that my first view was correct, and that all the specimens figured and mentioned above are identical.

With regard to the proboscis it is no doubt retractile, and the hooks may not always be visible, I certainly have seen them occasionally, and have many dried specimens which show them even in that state.

Plate III., fig. 3, is no doubt an accidentally prolonged proboscis, and figs. 8 and 8*a* may belong to a different species, but I possess only a single dried preparation of it, and therefore cannot apply the ova test. Figs. 9, 10, 11, 12, 13, and 14, are enlarged heads of immature specimens of the same Cestoid; fig. 15*a* being about the natural size of one, and figs. 16*d* and 16*e* show the manner (natural size and enlarged) in which the mature proglottides have burst, no lemnisci being discoverable. Figs. 7 and 7*a* are representations enlarged and natural size, respectively, of some of the few lemnisci-bearing specimens noticed before, these organs are situated on one side only.

The general form of the *T. Bairdii* is elegant, proportionate, and seldom exceeding seven inches in length, the segments of the "neck" are close together they soon widen out however, but never attain a large size, and of the most posterior proglottides it takes 45, to cover the space of half an inch. The lower margins are generally straight and the edges but slightly bulged out, though now and then more bell-shaped and irregular-margined, proglottides occur.

The head is generally round without, or pear-shaped with, a small proboscis; four oval disks are indicated but are

seldom very distinct, the same may be said with regard to the spines or hooks which in the greater number of specimens are absent or cannot be observed. These tape-worms are numerous in all the Australian Ducks examined, except in the Shoveller, in the Musk Duck and the Pink-eyed Duck. Some of the intestines are almost choked with them. Smaller cestoid worms occur from a quarter of an inch and less in length, all of which are immature specimens of the present, and probably of one or two other species.

On Plate III. will be found a sketch of these immature bodies which are very difficult to secure in a perfect state, and in most cases are destitute of the head; I have succeeded, however, in getting a large number of them and will add the following observations. The head generally resembles the mature heads of No. 4 (Plate III.), or the half grown form No. 13, the proboscis being rather large, and to use a popular expression "Top-heavy." specimens resembling fig. 26*a* of the same plate occur, and many like No. 27*a* are noticed, either with narrow and long, or with broad and short joints. In the latter case the head has evidently been lost; I have seen specimens, however, in which the first joint appears quite perfect. It is of no value to discuss every immature variety at present, I therefore draw attention to fig. 25 of Plate III. which may be considered the type of a young specimen of *Tenia Bairdii*, when from a quarter of an inch to half an inch in length. Examples of from one-eighth of an inch to less than a line in length occur in large numbers, all inhabiting, in company with perfectly mature colonies, the same host.

The quantity of young, half grown and mature colonies from a single water-fowl host is quite astounding, yet all the birds were in excellent condition, and did not appear to have suffered from their guests. On a few occasions I have noticed lemnisci thrust out in young specimens, but have not been able to preserve them, and confess that even with perfectly mature ones this is a rare occurrence. Among perhaps a thousand objects examined, I did not find six with the lemnisci visible. The best specimen is figured natural size, and enlarged on Plate III., figs. 7 and 7*a*.

Rudolphi illustrates a similar cestoid worm (*Entozoorum*

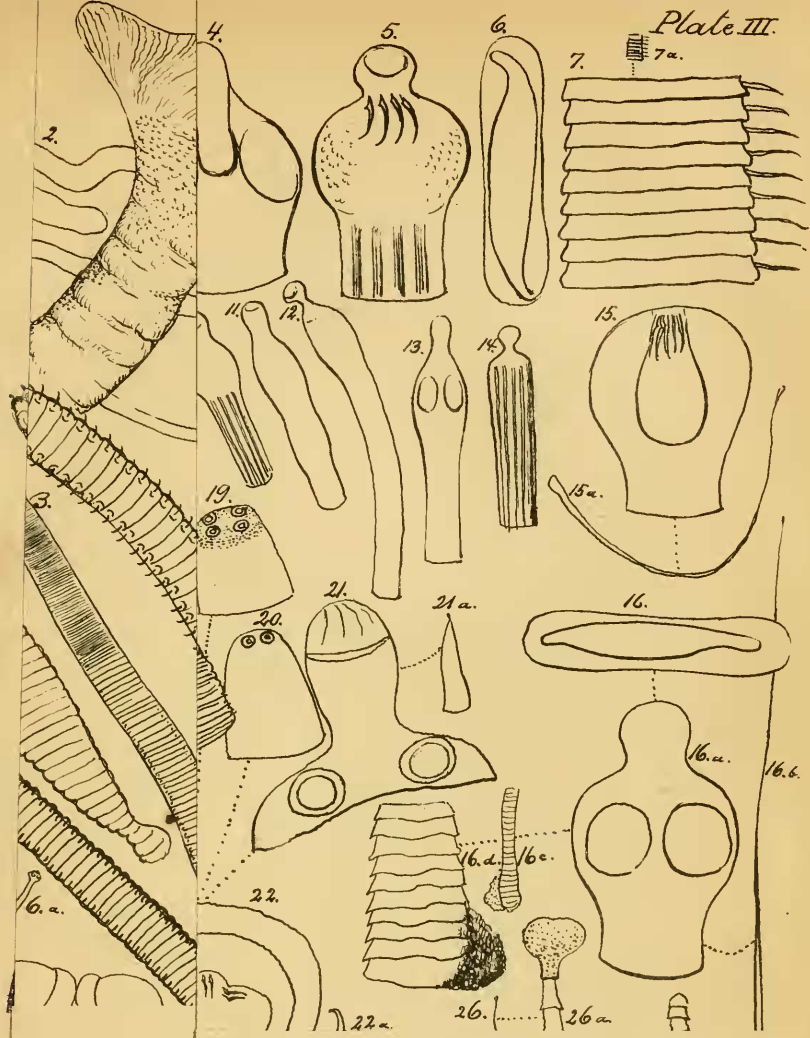
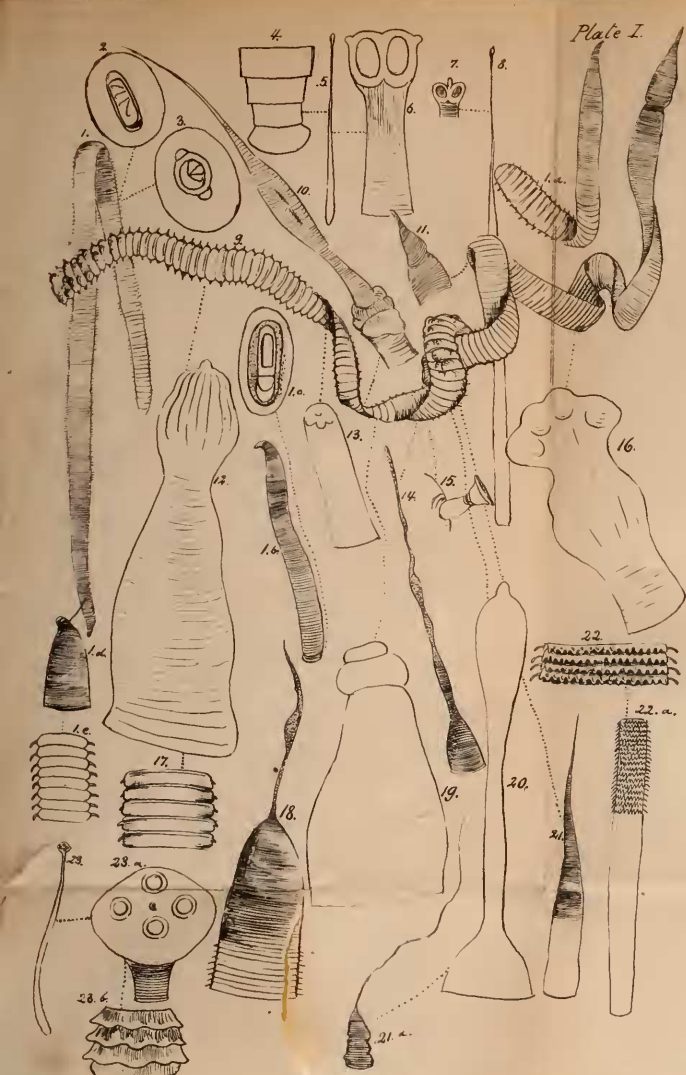
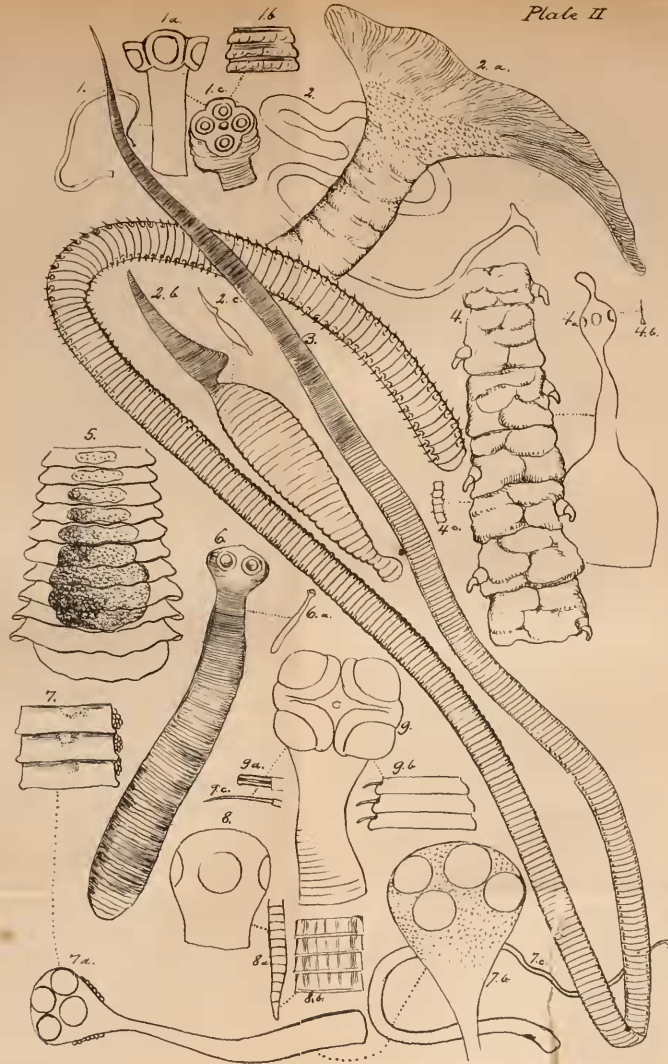


Plate I.



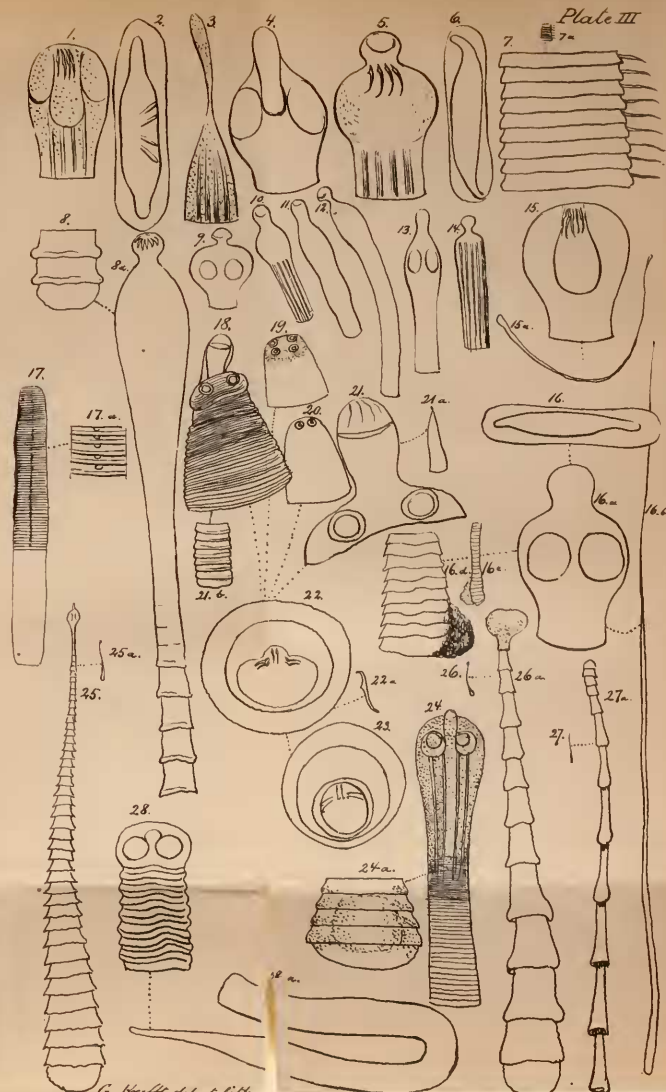
C. Kneff del. et lith.

Plate II



C. Kneff del. et lith.

Plate III



C. Kneff del. et lith.



sive vermium intestinalium, &c., Vol. II., Plate I., Tab. X., fig. 2), from the Woodcock (*Scolopax rusticola*) which resembles the young of *Tænia Bairdii*, and is probably also an immature form. This species is found in a great many of the Australian Ducks, in particular in the Black Duck (*Anas superciliosa*.)*

BOTHRIOCEPHALUS (?) MARGINATUS.

(Plate III., figs. 17 and 17a).

This species is founded on a fragment about $3\frac{1}{2}$ inches in length, without head, it is fully a line in thickness and nearly two-eighths of an inch wide; joints regular, straight, with very broad and raised margins below, and a slightly raised central papilla. The different segments are not produced outwards, and without the aid of a lens the outer margins appear perfectly straight. Mr. Masters who collected the specimen in some part of Queensland (Wide Bay district I believe) is of opinion that it was taken from the intestines of a Wallaby.

DESCRIPTION OF THE PLATES.

Plate I.

TÆNIA NOVÆ-HOLLANDIÆ.

Fig. 1. —Natural size.

Fig. 1a.—A smaller specimen of the same species.

Fig. 1b.—Another fragment of the same worm. The more perfect proglottides have parted, and the ovum which is marked fig. 1c differs consequently from the more perfect ova.

Fig. 1d.—Anterior portion of the specimen No. 1 enlarged.

Fig. 1e.—Proglottides, with lemnisci enlarged, taken from the posterior portion of the colony.

* I have just ascertained that the tape-worm figured on Plate III., figs. 24 and 24a which I thought was new, is identical (if ova are a test) with *T. Bairdii*. No lemnisci have been seen in this specimen, which was taken from a Stilted Plover.

Fig. 2. —Ovum of the same species with four hooks.

Fig. 3. —A second ovum, probably in a more advanced stage.

TÆNIA FORSTERI.

Fig. 4. —Terminal proglottides enlarged.

Fig. 5. —Outline sketch showing the natural size.

Fig. 6. —Head and neck enlarged.

TÆNIA CORONATA.

Fig. 7. —Head enlarged.

Fig. 8. —Outlines of perfect colony, natural size.

TÆNIA TUBERCULATA.

Fig. 9. —Perfect colony of the natural size.

Fig. 10. —Head and neck, (enlarged) one of the many varieties of heads.

Fig. 11. —Head natural size, second variety.

Fig. 12. —Head much enlarged, third variety.

Fig. 13. —Head enlarged, fourth variety.

Fig. 14. —Head enlarged, fifth variety.

Fig. 15. —Lemniscus observed in one specimen.

Fig. 16. —Head much enlarged, sixth variety.

Fig. 17. —Proglottides with lemnisci, enlarged.

Fig. 18. —Head enlarged, eleventh variety.

Fig. 19. —Head much enlarged, seventh variety.

Fig. 20. —Head enlarged, eighth variety.

Fig. 21. —Head, natural size, ninth variety.

Fig. 21a.—Head, natural size, tenth variety.

TÆNIA FIMBRIATA.

Fig. 22. —Proglottides and lemnisci (enlarged).

Fig. 22a.—Fragment, natural size.

TÆNIA FLAVESCENS.

Fig. 23. —Perfect Colony, natural size.

Fig. 23a.—Head, much enlarged.

Fig. 23b.—Terminal proglottides.